REMARKS

The present Amendment amends claims 1-8, 10-15, 17-20, 22 and 24 and leaves claims 9, 16, 21, 23, 25 and 26 unchanged. Therefore, the present application has pending claims 1-26.

The Examiner is respectfully requested to contact Applicants' Attorney by telephone to schedule an interview to discuss the outstanding issues of the present application prior to examination.

In paragraph 2 of the Office Action the Examiner objected to Figs. 17-26 as not having the legend "Prior Art". Filed on even date herewith are Proposed Drawing Corrections adding the legend "Prior Art" to Figs. 17-26. Therefore, this objection is overcome and should be withdrawn.

In paragraph 3 of the Office Action the Examiner alleges that the specification has not been checked to the extent necessary to determine the presence of all possible minor errors. The specification was reviewed and minor errors grammatical and editorial in nature were corrected. Therefore, this objection is overcome and should be withdrawn. The Examiner's cooperation is respectfully requested to identify any errors the Examiner may be aware of so that such errors can be corrected so as to expedite prosecution of the present application.

Claims 1-3, 10, 11, 17 and 18 stand rejected under 35 USC §103(a) as being unpatentable over Toru (JP 09-247128) in view of Papadakis (U.S. Patent No. 5,461,921); and claims 4-9, 12-16 and 19-26 stand rejected under 35 USC §103(a) as being unpatentable over Toru in view Papadakis and further in view of Applicants' alleged admitted prior art (AAPA). These rejections are traversed for the following

reasons. Applicants submit that the features of the present invention as now more clearly recited in claims 1-26 are not taught or suggested by Toru, Papadakis or Applicants' alleged admitted prior art whether taken individually or in combination with each other as suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw these rejections.

Amendments were made to the each of the claims to more clearly recite that the present invention is directed to a digital signal transmission system, a digital receiver and a method of displaying a digital signal transmission condition in the digital signal receiver.

According to the present invention, the digital signal transmission system makes use of a digital modulation system including a digital signal transmitter having a first digital signal processor unit producing a digital signal which includes a plurality of signal units each having a guard interval to reduce multi-path effect and a digital signal receiver which receives the digital signal from the digital signal transmitter.

According to the present invention, the digital signal receiver includes a second digital signal processing unit for processing the digital signal from the digital signal transmitter and outputting a digital modulated signal and a correlation value signal from the digital modulated signal, a signal converter, coupled with the second digital signal processing unit and supplied the correlation value signal therefrom, for generating at least a main wave signal level and a ghost imaging signal level corresponding to the correlation value signal, and a display coupled with the signal converter, for displaying a waveform corresponding to the main wave signal level

and the ghost imaging signal level in each horizontal scanning period of the display to indicate a transmission condition in the digital transmission system.

The above described features of the present invention now more clearly recited in the claims are not taught or suggested by Toru, Papadakis or Applicants' alleged admitted prior art whether taken individually or in combination with each other as alleged by the Examiner. Therefore, reconsideration and withdrawal of the above described rejections is respectfully requested.

Toru teaches a method for receiving a digital signal in which error correction coding is carried out in a manner so as to maintain the quality of the signal in which error correction coding was carried out. Toru teaches that the error of the demodulating digital signal is corrected in accordance with a prescribed error correcting system, and an error rate are calculated and reported. (Abstract). However, Toru et al does not teach displaying of a main wave signal level and a ghost signal level wave forms on a display.

Drawing 2 of Toru shows a frame structure of a OFDM signal as apparent from the description in paragraph 0029 and the explanation of Drawing 2. Drawing 3 of Toru shows an output waveform of correlator 4 as shown in Drawing 1 as apparent from the description in the paragraph 0032 and the explanation about Drawing 3. In paragraph 32 of Toru, it is stated that the 1st peak with the highest level is a peak by the direct wave, and two or more peaks to which the level after the 2nd falls gradually are delay peaks (in Drawing 3 two waves). It is further stated in Toru that since the location at which the peak with the highest level produced is a location of the signal received on the highest level, in the synchronous playback

section 7, predetermined regeneration is performed based on the 1st peak. That is, the 1st peak by the direct wave and the peak by the delay wave are only outputs from the correlator 4. The display device 13 of Toru does not display the direct wave and the peak by the delay wave. In contrast, according to the present invention, <u>a waveform corresponding to the main wave signal level and the ghost imaging signal level is displayed in each horizontal scanning period of the display to indicate a transmission condition in said digital transmission system</u>. Such features are clearly not taught or suggested by Toru.

In the paragraph 0033 of Toru, concerning the multi-path detection arithmetic circuit 8, it is stated that the output of correlator 4 is supplied to the multi-path detection arithmetic circuit 8, and compared with the criteria synchronizing signal which the criteria data storage section 6 has memorized beforehand by performing logical operation. Thus, in Toru and a multi-path time delay is found for the level difference of the peak of a direct wave and a delay wave to a DU ratio (desired-undesired ratio) from the number of the peaks of the output of correlator 4 from the location of a peak where the multi-path wave number is tine.

However, paragraph 0033 of Toru does not teach or suggest that <u>a waveform corresponding to the main wave signal level and the ghost imaging signal level is displayed in each horizontal scanning period of the display to indicate a transmission condition in said digital transmission system</u> as recited in the claims.

It shoulbe noted that Toru shows a rectangular wave of the output from correlator 4. However, the present invention does not display the rectangular wave for the peak levels. According to the present invention, <u>a waveform corresponding to</u>

the main wave signal level and the ghost imaging signal level is displayed in each horizontal scanning period of the display as recited in the claims. Thus, according to the present invention a sharp triangular waveform is produced and displayed as shown in Figs. 2B, 9A, 10A-10E, 28, 31, 44A and 44B of the present application. The peak point of the sharp triangular waveform represents the position with the highest correlation value. The user can easily check the position of the highest peak. Such features and functions are not possible in Toru.

Toru teaches in paragraph 0002 that in the case of the analog transmission, at the broadcasting station of a receiving side, the receiving level of a RF signal was supervised, or the multi-path and the interference were supervised by the waveform monitor, and the location and sense of a receiving antenna were adjusted to it so that optimal reception could be performed.

Toru further teaches in paragraph 0003 that in digital transmission, since it was not able to check whether optimal reception is performed even if it supervises a wave, the location and sense of a receiving antenna were adjusted so that only the receiving level of a RF signal might be supervised and the maximum receiving level might be obtained.

Toru still further teaches In paragraph 0004 that it was difficult to always maintain the quality of the signal which error correction coding was carried out, was modulated and was transmitted in adjustment of the receiving antenna in the above-mentioned digital transmission, for example from the relay car which moves.

Toru still further yet teaches in paragraphs 8 and 17 that the oscillation from which a frequency changes according to said error rate was considered. In

paragraphs 9 and 18, it is stated that it considered as the configuration in which said error rate is displayed on a display.

Toru even further teaches in paragraph 13 that it considered as the configuration which contains further the display step which displays the level of said signal by which frequency conversion was carried out, and the information about said multi-pass on a display. In paragraph 14, it is stated that information about said multi-pass was considered as the configuration containing at least one of the number of said multi-passes, a time delay, and level.

Considering each of the above noted teachings of Toru it becomes quite clear that Toru does not teach or suggest <u>a display for displaying a waveform corresponding to the main wave signal level and the ghost imaging signal level in each horizontal scanning period of the display</u> as recited in the claims.

Toru teaches in paragraph 41 that performing the display functions described above with the display 13 can report the bit error rate of decoded digital data, the receiving level of RF signal 2, and information about the multi-path of RF signal 2 visually to the coordinator of a receiving antenna 1. However, this <u>a display for displaying a waveform corresponding to the main wave signal level and the ghost imaging signal level in each horizontal scanning period of the display</u> as recited in the claims.

Paragraphs 44 and 47 of Toru merely teach that the information about multi-path, bit error rate and receiving level is displayed. Thus, there is no teaching of the display of the wave signal level and the ghost imaging signal level waveforms as recited in the claims.

Therefore, as is quite clear from the above, the features of the present invention as now more clearly recited in the claims are not taught or suggested by Toru whether taken individually or in combination with any of the other references of record. Particularly, the features of the present invention shown above not to be taught or suggested by Toru are also not taught or suggested by Papadakis or Applicants' alleged admitted prior art.

Papadakis discloses a technique of direct-sequence spread-spectrum ultrasonic testing device in which ultrasonic energy is transmitted to a test object 28 to detect an internal flaw of the test object 28 as apparent from Fig. 1. Further, as stated in column 6, lines 16-42 as "the data in Fig. 3a represents a unique signature signal obtained by the ultrasonic flaw detection system 6 when the test object 28 was known to contain no flaws ,.... Fig. 3b shows a second signature signal obtained from the same test object 28 by the ultrasonic flaw detection system 6 at a later date. The resulting difference is shown in Fig. 3c.", Papadakis relates to a flaw detecting system for an object by using ultrasonic wave.

In contrast, the present invention relates to <u>a digital signal transmission system using a digital modulation system including a digital signal transmitter and a digital signal which includes a plurality of signal units, each of which includes a guard interval to reduce the multi-path effect</u>. The present invention is completely different from the flaw testing system disclosed in Papadakis.

With respect to claims 3, 11, and 18, the Examiner has stated that it would have been obvious to one of ordinary skill in the art that Toru in view of Papadakis satisfies the limitations of the claim. However, neither of the references teach or

suggest that the display simultaneously displays the BER signal, and the field intensity signal in association with the main wave and a reflected wave as recited in the claims. In particular, simultaneous displaying of the main wave and the reflected wave is not taught by any of the references of record.

According to the present invention, by simultaneously displaying of main wave and the reflected wave, an operator can see the degree of delay of the reflected wave from the main wave and know how the reflected wave affect to the received signal. For example, in a case that the delay of the reflected wave with respect to the main wave is shorter than a predetermined time (e.g. a guard interval period), there is no effect of the reflected wave. In a case that the delay of the reflected wave with respect to the main wave is longer than a predetermined time (e.g. a guard interval period), the signal transmission condition in the signal path would be degraded due to effect by delay of the reflected wave. Furthermore, when BER is also displayed in addition to the simultaneous displaying of the main wave and the reflected wave, the quality of the signal transmission path can be estimated. When the reflected wave is delayed over the guard interval period, the value of BER is rapidly increased. This represents degradation of the quality of transmission path. Accordingly, the operator can judge the condition of the transmission path as to whether the transmission condition is about to begin a sharp degradation or there is still a substantial margin for good transmission quality. The condition is about to begin a sharp degradation means that the delay of the reflected wave with respect to the main wave is equal or slightly shorter to/than the guard interval period so as to narrowly escape bad transmission condition. That is, if the reflected wave is further delayed at all, the

transmission condition will be sharply degraded. On the other hand, in the condition that there is still a substantial margin for good transmission quality, the delay time of the reflected wave is very shorter than the guard interval period and the good quality of the transmission condition can be maintained.

Further, by displaying the field intensity of the digital signal, the degradation of the receiving condition can be known in displaying a low intensity displayed. When the field intensity becomes lower than a predetermined value (e.g. around -90dBm), the BER is rapidly increased, so that the operator can judge the condition of the transmission path as to whether the transmission condition is about to begin a sharp degradation or there is still a substantial margin for good transmission quality. The condition is about to begin a sharp degradation means that the field intensity is equal or slightly larger to/than the predetermined value so as to narrowly escape bad transmission condition. That is, if the field intensity is further reduced at all, the transmission condition will be sharply degraded. On the other hand, in the condition that there is still a substantial margin for good transmission quality, the delay time of the reflected wave is very larger than the predetermined value and the good quality of the transmission condition can be maintained.

As explained above, not only by displaying the main wave and reflected wave simultaneously, but also by displaying BER and field intensity on a display, the operator can judge the condition of the transmission path as to whether the transmission condition is about to begin a sharp degradation or there is still a substantial margin for good transmission quality, as well as the quality of transmission condition. The operator can make above judgments by only looking at

the display without moving his or her eyes widely. Such is clearly not possible in any of the references of record.

With respect to claims 4, 12, and 19, concerning the guard interval, the Examiner has stated that the AAPA discloses that in an OFDM modulation system it is common practice to add a guard interval to each signal unit in order to reduce the multi-path effect. However, as apparent from the description in page 2, lines 5-15 and page 4, lines 3-23 of the present application, the guard interval is inserted in each signal unit. For example, in an OFDM signal, one symbol consists of 1,072 samples. In 1,072 samples, 1,024 samples are used for transmitted data and 48 samples are used for guard intervals. The signal units, each of which is formed by one symbol, are strung to form a transmission signal. The above description in the specification explains the frame structure of the digital transmission signal.

The features of the present invention recited by claims 4, 12 and 19 includes a description that the signal converter further generates a guard interval signal corresponding to a period of said guard interval of said digital signal received, and said display further displays a guard-interval based on said guard interval signal in association with said main wave and said reflected wave. These features of the present invention are not taught or suggested by any of the references or record.

By displaying the guard interval in association with the main wave and the reflected wave, the operator can recognize at a glance that the reflected wave is delayed by more than a guard interval with respect to the main wave. If the delay of the reflected wave is smaller than a guard interval, there is almost no effect of the reflected wave on the received signal. If the delay of the reflected wave is more than

the guard interval, the transmission condition becomes degrade doe to the effect of the reflected wave. Accordingly, by displaying the guard interval in association with the main wave and the reflected wave, the operator can judge whether the transmission condition is degraded by the effect of the reflected wave. Such cannot be accomplished by any of the references of record.

With respect to claims 5, 13 and 20, the Examiner has stated that Papadikis further discloses the signal converter generates a time scale signal and the display further can display a time scale based signal waveform as generated by the converter. Claims 5, 13 and 20 recite that the signal converter further generates a time scale signal and said display further displays a time scale based on said time scale signal in association with said main wave and said reflected wave. These features are not taught or suggested by Papadakis or any of the other references of record.

By displaying the time scale in association with the main wave and the reflected wave, a building, which causes the reflected wave, can be specified, error judgment on the delay time of the reflected wave caused by difference of the time scales in the different display sizes can be avoided, and when the guard interval is also displayed effect of the reflected wave can be judged by checking the shifting of the guard interval period on the time scale. Such features of the present invention are clearly not possible in any of the references of record.

Thus, as is quite clear from the above, the features of the present invention as now more clearly recited in the claims are not taught or suggested by Papadakis or Applicants' alleged admitted prior art whether taken individually or in combination

with Toru as suggested by the Examiner. Therefore, reconsideration and withdrawal of the 35 USC §103(a) rejection of claims 1-3, 10, 11, 17 and 18 as being unpatentable over Toru in view of Papadakis and the 35 USC §103(a) rejection of claims 4-9, 12-16 and 19-26 as being unpatentable over Toru in view of Papadakis and further in view of Applicants' alleged admitted prior art is respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references utilized in the rejection of claims 1-26.

In view of the foregoing amendments and remarks, Applicants submit that claims 1-26 are in condition for allowance. Accordingly, early allowance of claims 1-26 is respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (500.39930X00).

Respectfully submitted,

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FIG. 17 Prior Art

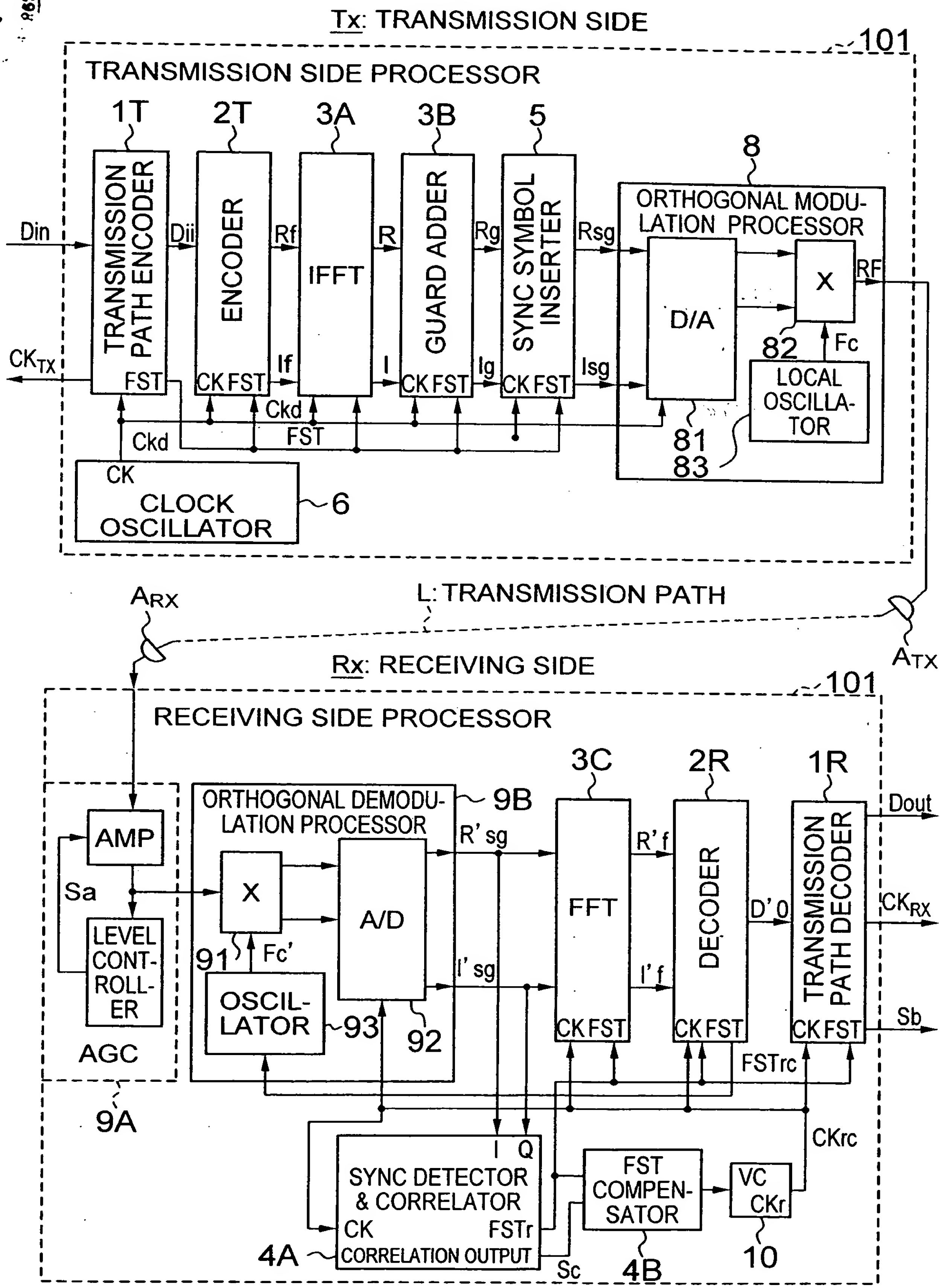

FIG. 18 Prior Art

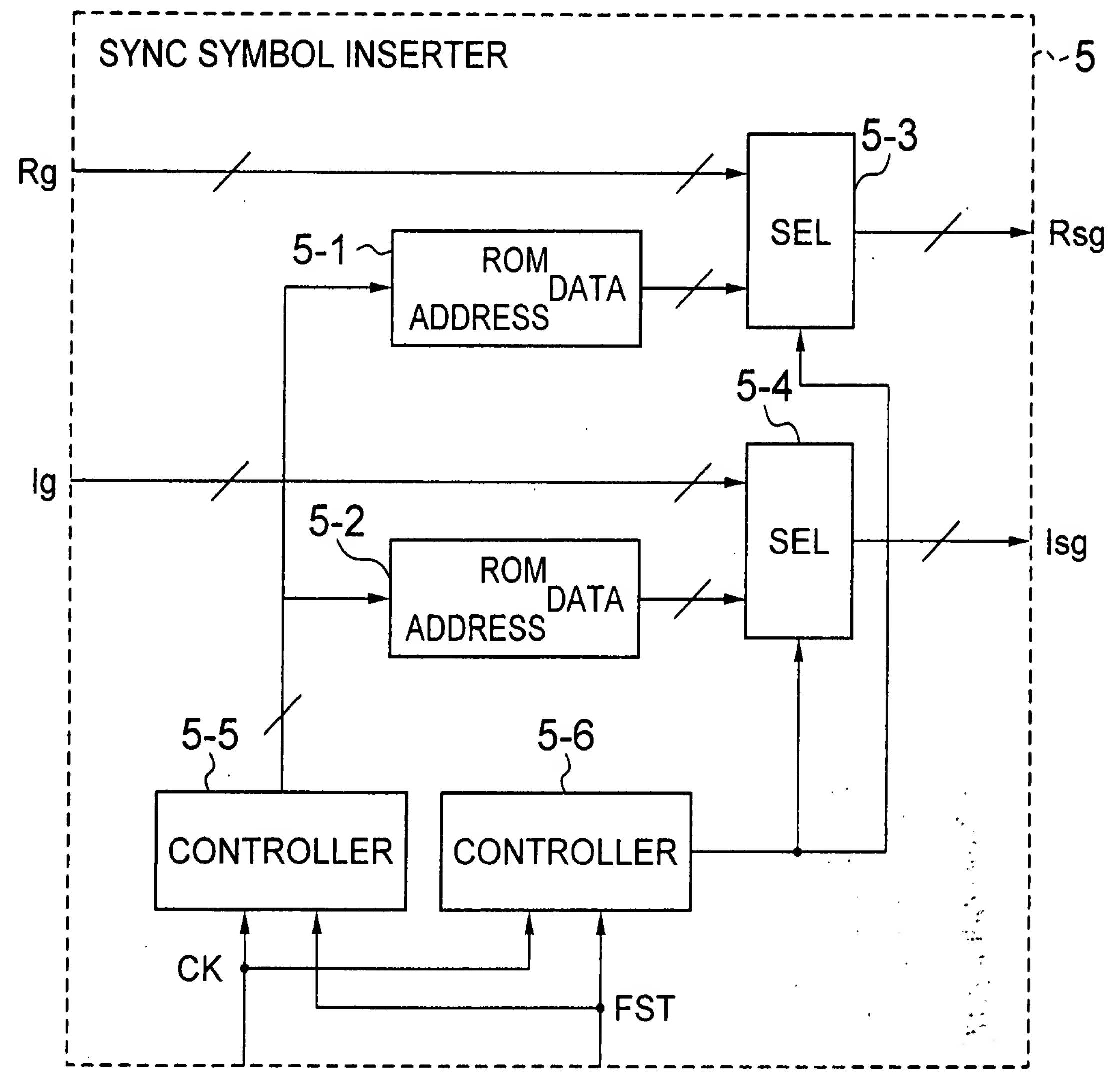

FIG. 19 Prior Art

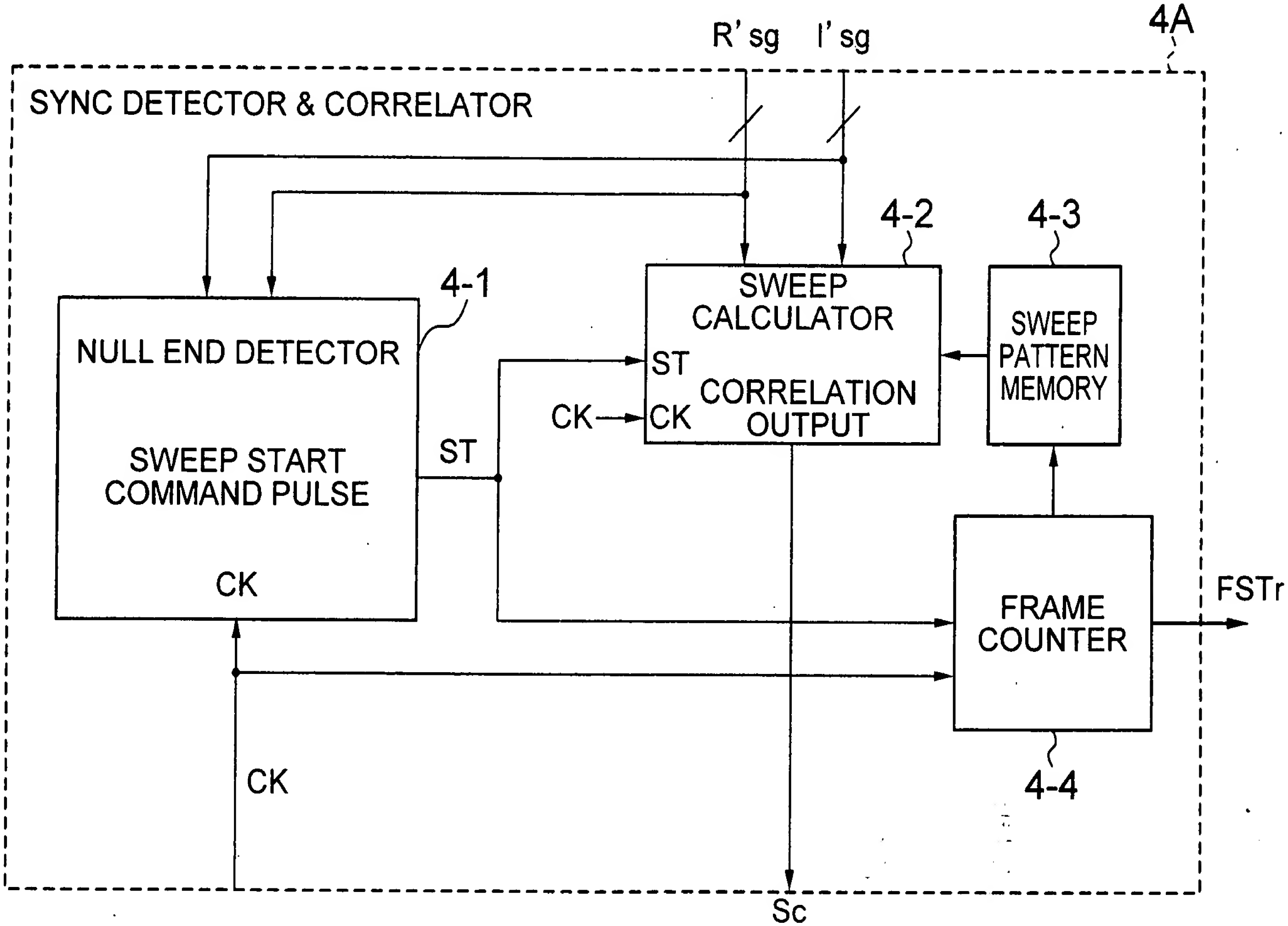

FIG. 20 Prior Art

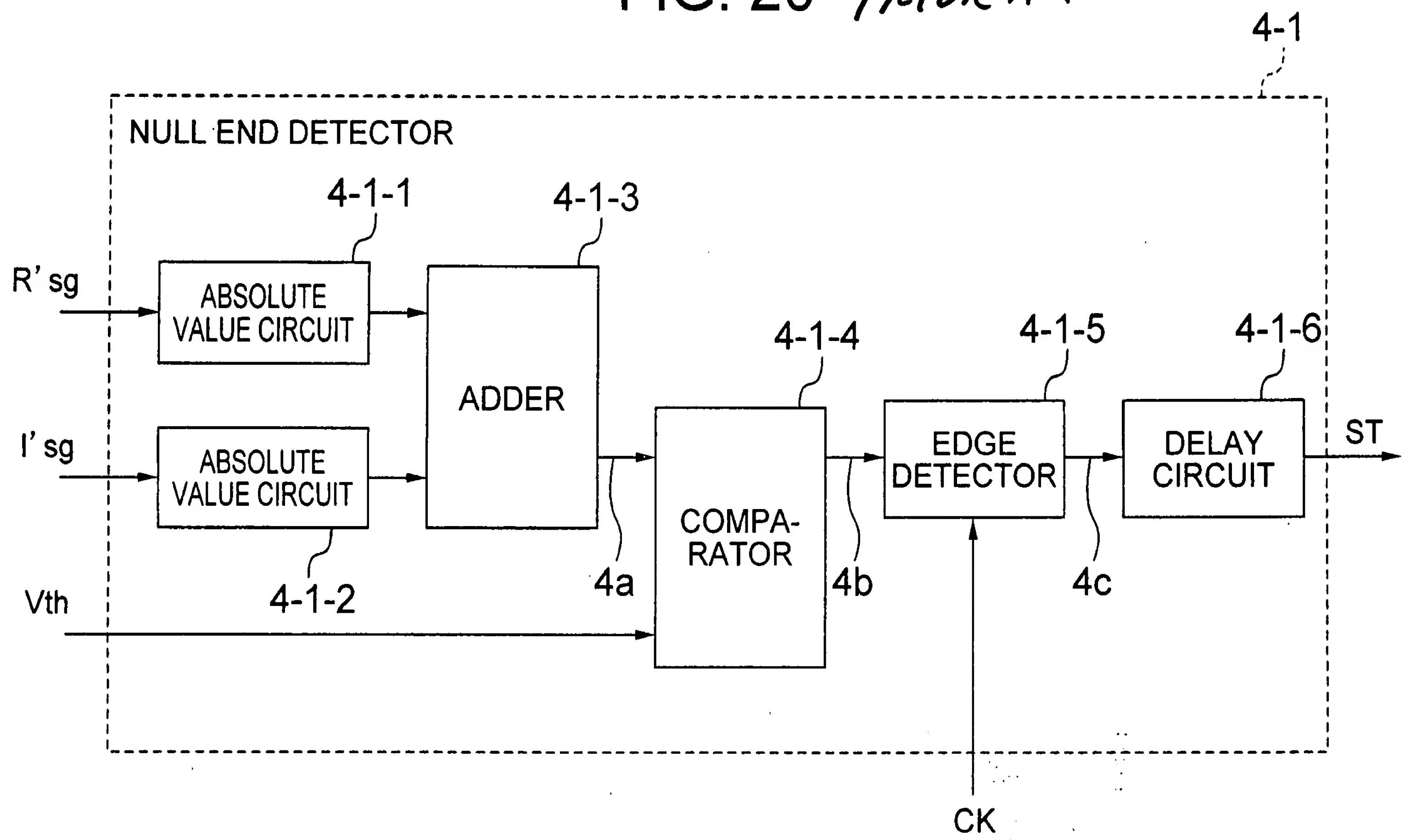

FIG. 21 Prior Art

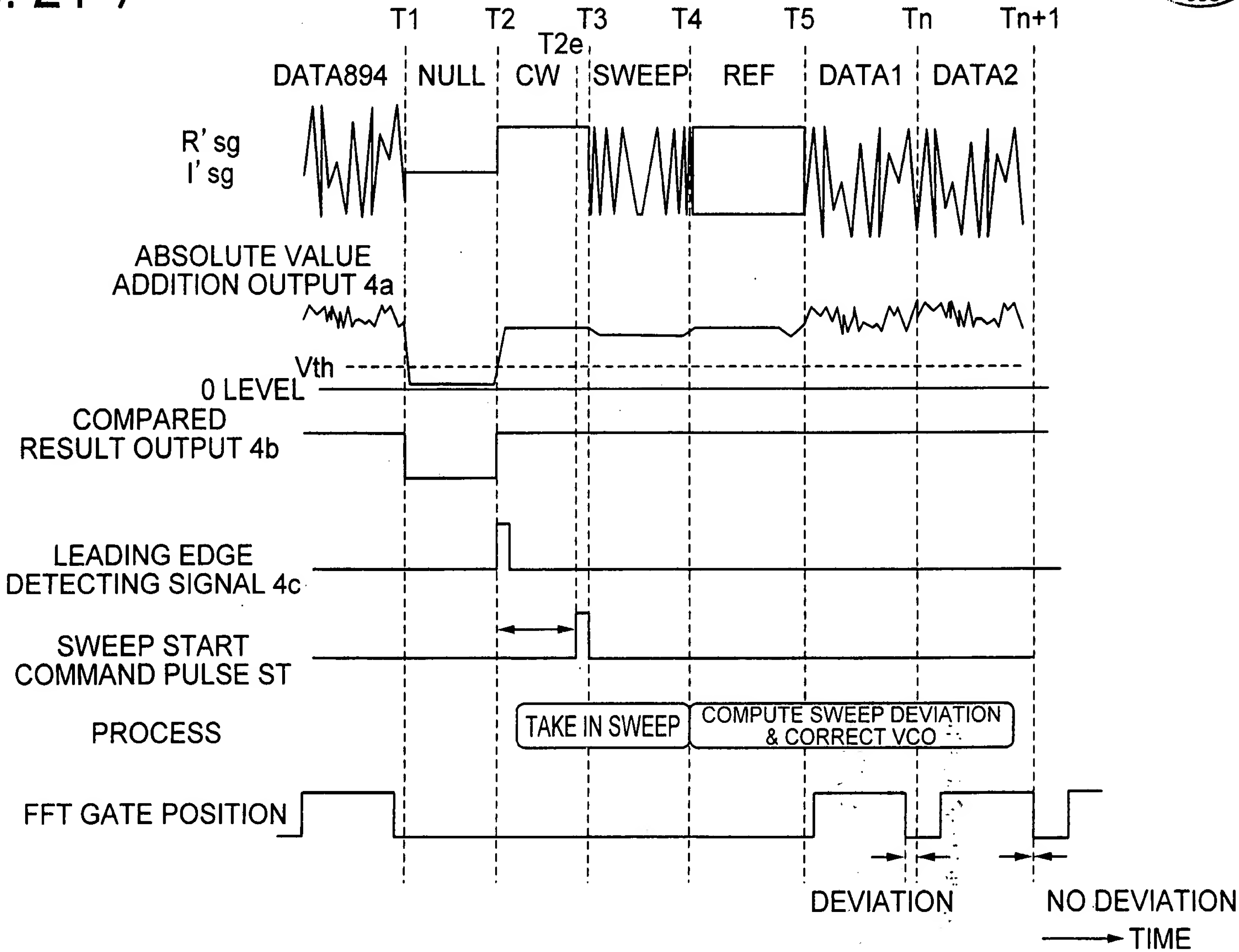

FIG. 22A Prior Art

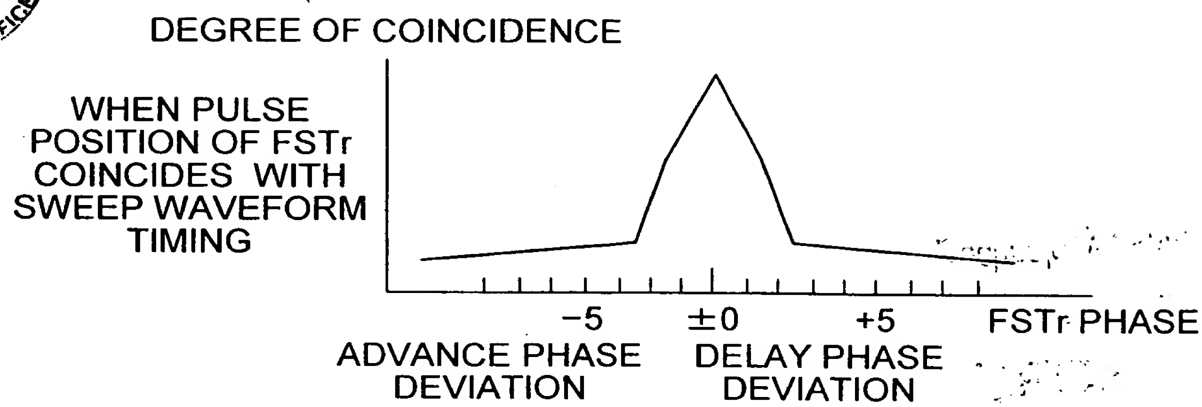

FIG. 22B Prior Art

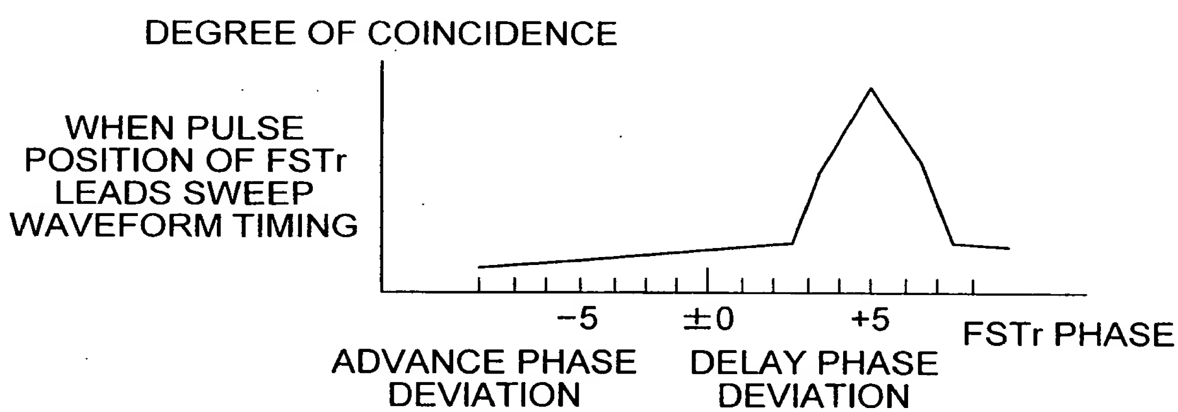

FIG. 22C Prior Art

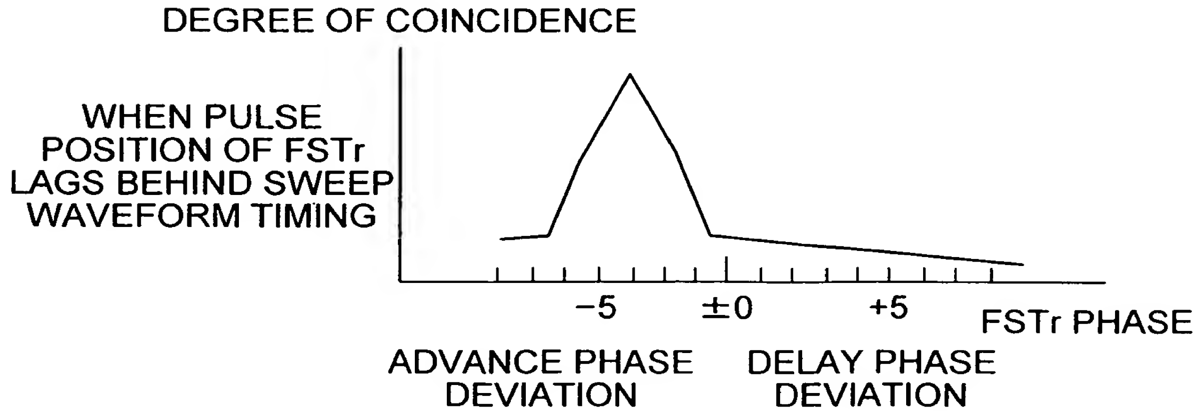

FIG. 23 Prior Art

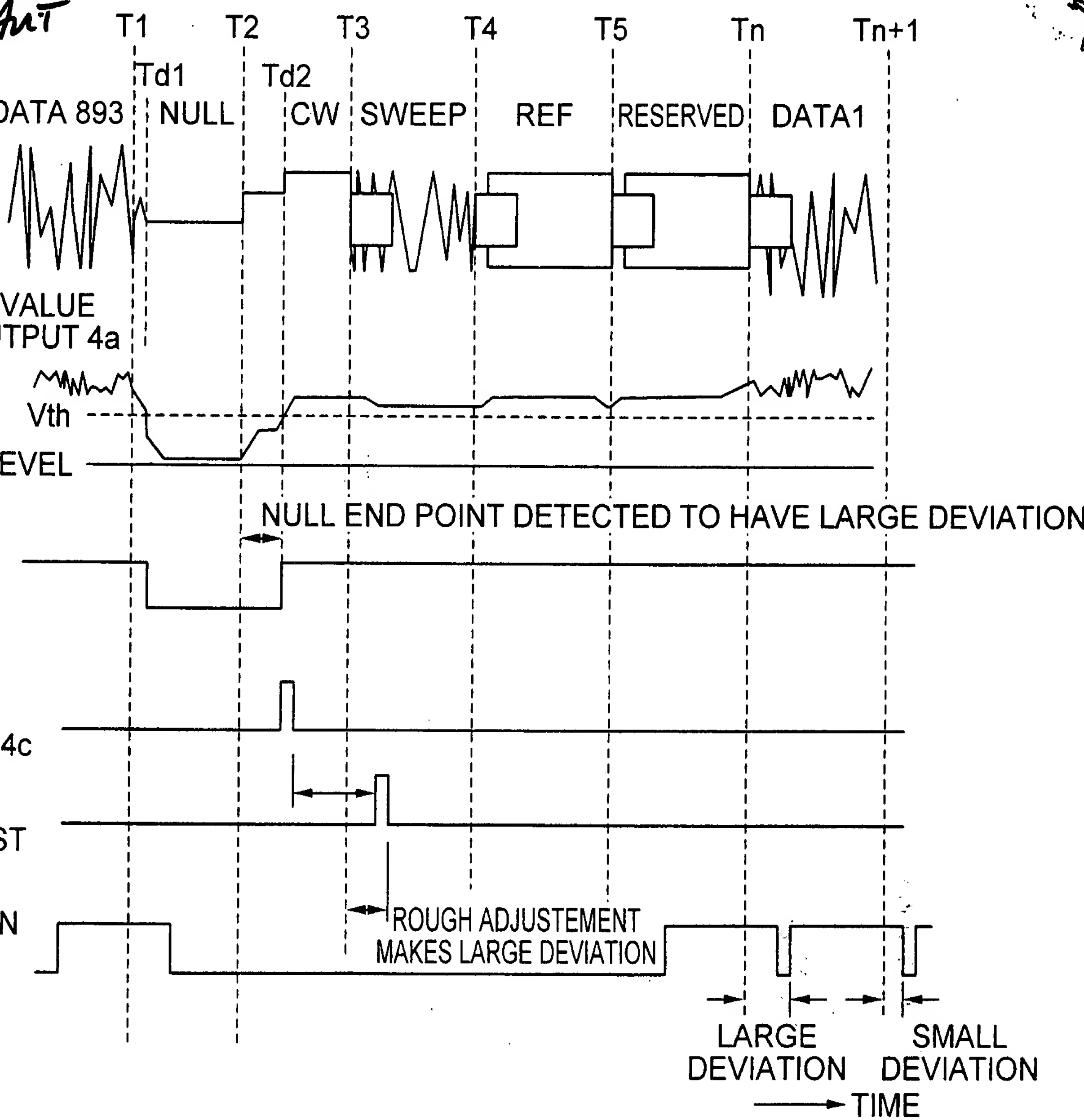

FIG. 24 Prior Art

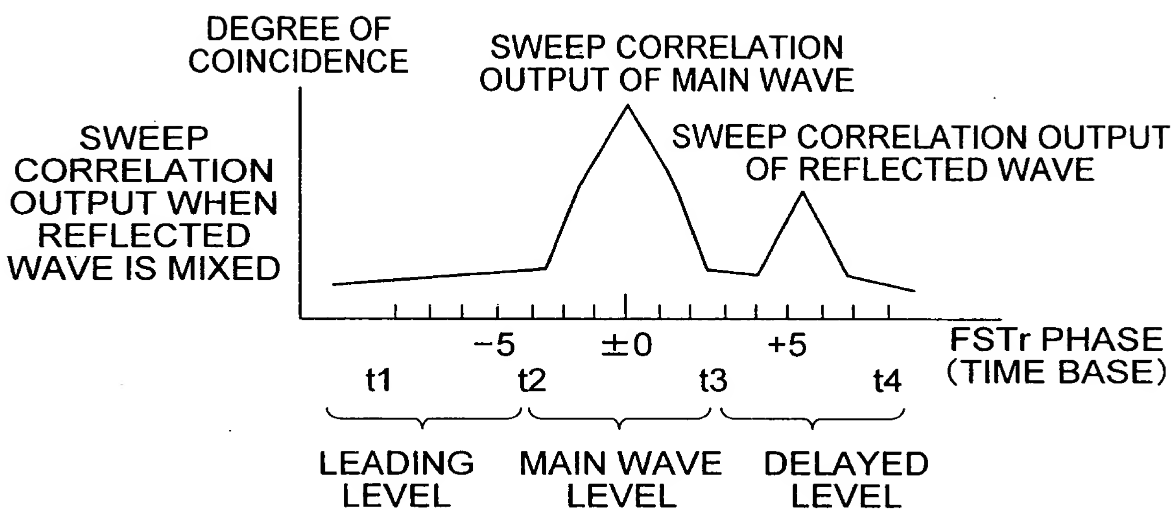

FIG. 25 Prior Art

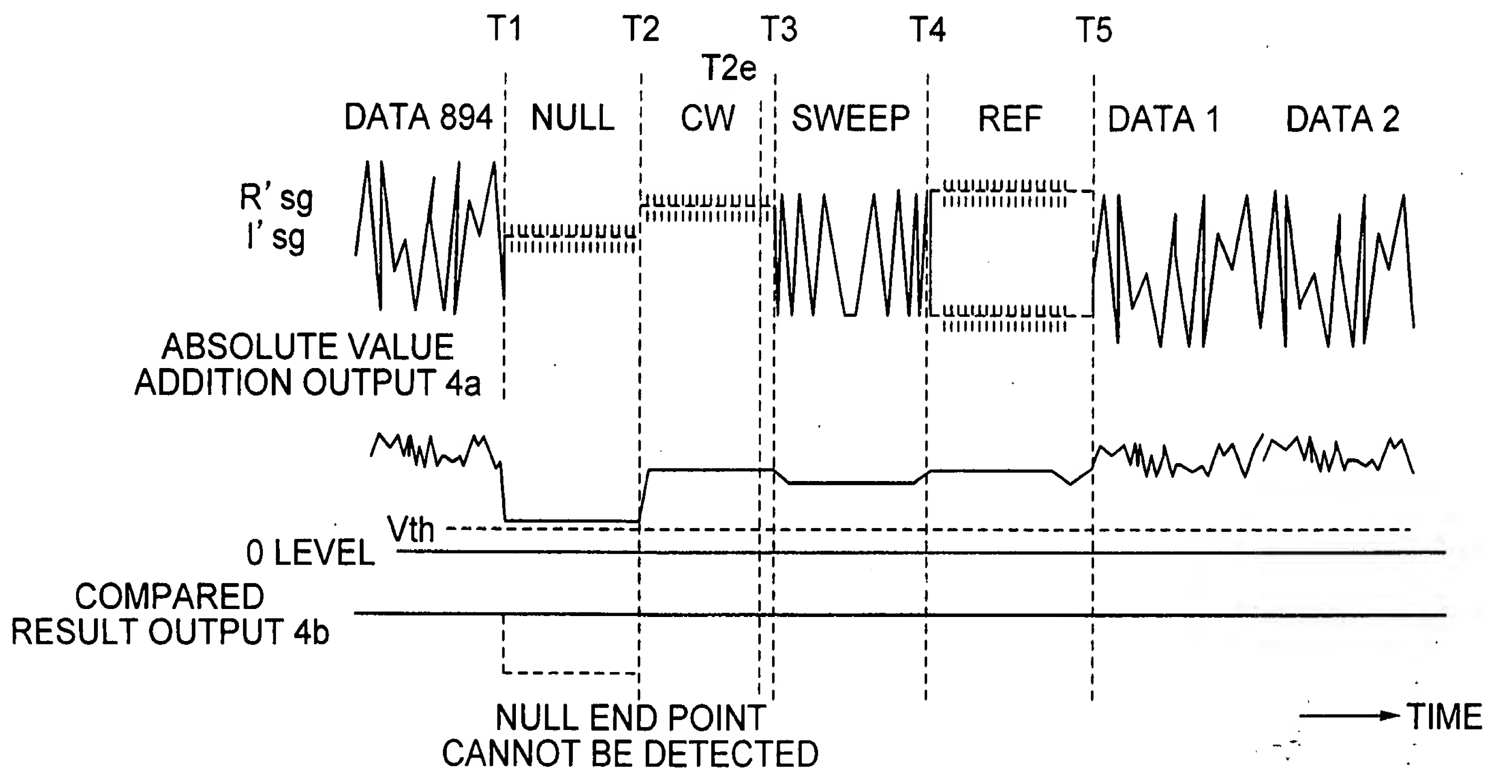

FIG. 26 Prior Art